

The clinical diagnosis of acute purulent sinusitis in general practice — a review

Morten Lindbæk and Per Hjortdahl

SUMMARY

Acute sinusitis is a common illness in primary care. Studies have demonstrated the difficulty of making the differential diagnosis of acute purulent sinusitis based on clinical evaluations alone. This leads to a significant overuse of antibiotics, which in turn may contribute to increased bacterial resistance.

In most cases, GPs have to base their differential diagnosis of sinusitis on clinical signs and symptoms and examination of the patient. The aim of this review is to assess which clinical signs and symptoms can predict an acute purulent sinusitis, compared with accepted reference standards.

A review of the literature was performed by looking at articles related to the diagnoses of acute sinusitis in general practice. The following search criteria were used: unselected general practice population; objective reference standard; and logistic regression to evaluate symptoms and signs independently associated with the diagnosis.

Four studies were identified for further analysis. The following symptoms and signs were associated with acute purulent sinusitis: purulent secretion as a symptom experienced by the patient or as a sign demonstrated in the nasal cavity by the doctor; pain in the teeth; pain at bending forward, and two phases in the illness history. An elevated erythrocyte sedimentation rate and increased C-reactive protein also contributed to the diagnosis.

By use of the specified signs and symptoms the GP can increase the probability of correctly diagnosing an acute purulent sinusitis and reserve antibiotic prescription for these patients.

Keywords: sinusitis; acute; sign; symptom; reference standard.

Introduction

ACUTE sinusitis, an inflammation in the paranasal sinuses lasting no more than one month, is a common illness in primary care. The condition can exist as either purulent or serous sinusitis; only purulent sinusitis benefits from antibiotic treatment.¹ Several studies have demonstrated that differential diagnosis is difficult based on clinical judgment alone; the frequency of confirmed sinusitis varies between 38% and 63%.²⁻⁵ The uncertain diagnosis results in a significant overuse of antibiotics, which in turn contributes to increased bacterial resistance.⁶

The most accurate and cost-effective method for diagnosing acute sinusitis remains uncertain. Possible diagnostic tests that may be used in clinical practice include radiography, computed tomography, and ultrasonography. Sinus puncture is considered to be the 'gold standard' for acute purulent sinusitis and purulent secretions on aspiration provide direct evidence for the condition. However, sinus puncture can only rarely be clinically justified, given its inconvenience and associated patient discomfort. The diagnostic quality of the other three reference methods has been evaluated in two recent reviews.^{7,8}

In day-to-day clinical practice, the diagnosis of purulent sinusitis generally is based on clinical clues, giving the decision of antibiotic treatment an uncertain basis. However, in the future GPs will still probably have to base their diagnosis on clinical symptoms and signs and patient examination in uncomplicated cases of purulent sinusitis.

The aim of this study was to systematically review the scientific literature to evaluate the efficacy of clinical assessment and close examination of patients in diagnosing purulent sinusitis in the general practice population.

Method

Search strategy

A search was conducted on the MEDLINE database on papers from the year 1966 to May 2001 along with a manual search using previous knowledge in the field. The medical subject headings (MeSH) terms 'sinusitis acute', 'sinus infection', 'diagnosis', 'primary care' and 'general/family practice' were used in all combinations.

Inclusion criteria/methodological standards

Studies were included where clinical symptoms, signs, and blood tests were compared with an objective reference standard. Sinus puncture, computed tomography (CT), X-ray, or ultrasonography were accepted as reference standards. A logistic regression analysis was performed to look for independent predictors of purulent sinusitis. The target population was adults with a suspected acute sinusitis in primary care. Studies that involved children, chronic sinusitis or where the study population was drawn from specialist practice, were therefore excluded.

Methodological standards relevant for this setting were used which were proposed by the Cochrane Collaboration

M Lindbæk, MD, PhD; P Hjortdahl, MD, PhD, Department of General Practice, University of Oslo.

Address for correspondence

Dr M Lindbæk, Department of general practice, University of Oslo, PO Box 1130 Blindern, N-0317 Oslo. E-mail: morten.lindbak@samfunnsmed.uio.no

Submitted: 10 May 2001; Editor's response: 22 August 2001; final acceptance: 21 January 2002.

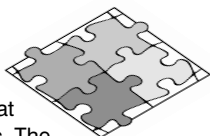
©British Journal of General Practice, 2002, 52, 491-495.

HOW THIS FITS IN*What do we know?*

Acute sinusitis is a common diagnosis that often leads to prescription of an antibiotic. The clinical diagnosis of acute purulent sinusitis is uncertain and there is conflicting evidence about the value of the clinical symptoms and signs.

What does this paper add?

This systematic review demonstrates clinical symptoms and signs and blood tests that have been associated with the confirmed diagnosis in a primary care setting. By use of these, the GP can increase the probability of diagnosing an acute purulent sinusitis.



Methods Working Group on Diagnosis and Screening.⁹ The following criteria for validity were sought:

- Were the clinical findings compared with a valid reference standard?
- Were the findings and reference standard measured blind against each other?
- Was the choice of patients assessed by the reference standard independent of the results of the clinical findings?
- Was the reference standard measured before any interventions were started with knowledge of the results?
- Were the clinical findings reported in a valid design?

Reference standard diagnostic criteria

Sinus puncture was regarded as positive if the puncture revealed purulent or mucopurulent secretion. In accordance with established criteria,¹⁰ ultrasound findings were considered positive if there were:

- scans showing a back wall echo greater than 3.5 cm from the initial echo;
- sinus radiographs findings with air–fluid level, complete opacity or mucosal thickening greater than 5 mm;⁴ or,
- sinus CTs with air–fluid levels, or complete opacity in any sinus.¹¹

Results**Search results**

The searches yielded 87 references. Of these, 29 were review articles, 21 were articles about treatment only, five looked at sinusitis in childhood, and ten were not eligible for other reasons (editorials, questionnaires, etc), leaving 22 eligible studies. Table 1 gives the reasons for further evaluation of these studies. Seven articles met the primary inclusion criteria, of which one was a double publication^{12,13} and one a triple publication,^{4,14,15} leaving four articles for final evaluation.

Methodological quality of included studies

Table 2 gives the evaluation of the methodological quality of the four included studies. The methodological approaches used were variable. Several types of categories and tabulations were used. Sensitivity and specificity were reported in most cases and likelihood ratios in all four. One of the studies recruited only male patients;⁴ the other three had similar

Table 1. Results of the literature searches.

Reasons for exclusion	Number of reports
Selected patient population	3
No clinical data given	6
Lack of reference standard	5
Retrospective study	1
Eligible reports	7
Total	22

sex distribution — two-thirds female and one-third male. All four studies met the main methodological demands and used logistic regression analysis, enabling the evaluation of symptoms and signs, individually and grouped.

In Table 3 the symptoms, signs and blood tests have been analysed and found to be independently associated with acute purulent sinusitis. To assess the strength of each of the associations, the likelihood ratio (LR) and frequency of each variable have been included. As there was no access to the original data, it was not possible to combine and analyse the aggregated data.

Purulent rhinorrhoea as a symptom was found to be associated with purulent sinusitis in three of the four studies. Pain in the teeth was found to be associated with the diagnoses in two of the studies, though not in the remaining two. Illness starting with upper respiratory tract infection was an association found in only one of the studies. The other two symptoms — two phases in the illness history and ineffectiveness of decongestants — were associated with one study each, but were not investigated in the others. Purulent secretion in the nasal cavity was associated with two of the studies, whereas pain at bending forward was associated with only one of the four studies. Transillumination of the maxillary sinuses was associated with one study, but not investigated in the others. An erythrocyte sedimentation rate (ESR) greater than 10 mm/h for males and greater than 20 mm/h for females was associated with purulent sinusitis in the two studies where it was investigated, while C-reactive protein (CRP) greater than 10 mg/l was associated with only one of the studies where it was investigated.

Table 4 shows the sensitivity and specificity of the three reference standards (ultrasonography, X-rays or CT) as compared with sinus puncture as the optimal reference standard.¹⁶ X-rays has been used in a number of studies but, as demonstrated in the table, there is a major difference if only patients with fluid level or total opacification are included, compared with when patients with mucosal thickening greater than 5 mm are also included.¹⁶ The result also varies for ultrasonography; a recent study demonstrated low sensitivity compared with sinus puncture.¹⁷ Sinus CT may have a high specificity when using fluid level and total opacification as the criteria for acute sinusitis; however, data are lacking. Data from previous studies show that the positive predictive value with these criteria is 0.90.³ CT also has the advantage of giving an adequate view of the smaller sinuses (frontal, sphenoidal and ethmoid sinuses), which frequently can be affected in sinusitis.¹¹

Two studies have been performed in ear, nose and throat (ENT) practice. Berg studied patients with illness duration of less than three months using puncture as the reference standard.¹⁸ He found four symptoms and signs to be associated with purulent sinusitis: history of purulent nasal discharge with unilateral predominance; history of bilateral purulent nasal discharge; history of facial pain with unilateral predominance; and pus in the nasal cavity on physical

Table 2. Characteristics of diagnostic studies of acute sinusitis in general practice identified by use of defined MeSH terms.

Study	Country/ year	Setting/ specialty	Patient characteristics				Study characteristics		Fraction of patients with sinusitis	Logistic regression
			Symptoms on entry	Age years	% male	Symptom duration	Blinded	Clearly defined		
Hansen ² — Clinical examination compared with puncture	Denmark, 1995	PHC	Doctor suspected	15–79	30	<30 days	Yes	Yes	89/168	+
Lindbæk ³ — Clinical examination compared with CT	Norway, 1995	PHC	Doctor suspected	16–69	32	<30 days	Yes	Yes	123/201	+
Williams ⁴ — Clinical examination compared with X-ray	USA, 1992	PHC	Headache, nasal symptoms, patient suspected	>17	100	<90 days	Yes	Yes	88/247	+
Van Duijn ⁵ — Clinical examination compared with ultrasonography	Holland, 1992	PHC	Doctor suspected	16–70	31	<30 days	Yes	Yes	212/400	+

Table 3. Symptoms, signs and blood tests independently associated with a confirmed diagnosis of acute sinusitis in four studies from general practice.^a

	Study				Total
	Hansen ²	Lindbæk ³	Williams ⁴	van Duijn ⁵	
Reference standard	Puncture <i>n</i> = 174	CT sinus <i>n</i> = 201	X-ray <i>n</i> = 247	Ultrasound <i>n</i> = 441	
Association	LR (frequency)	LR (frequency)	LR (frequency)	LR (frequency)	
Symptoms ^a					
Purulent rhinorrhoea	–	1.5 (78)	1.5 (59)	1.9 (47)	3+ 1–
Pain in teeth	–	–	2.5 (11)	2.1 (26)	2+ 2–
Beginning with common cold	–	–	–	1.4 (78)	1+ 3–
Unilateral maxillary pain	–	–	–	1.8 (27)	1+ 3–
Two phases in history	0	2.1 (59)	0	0	1+
Lack of response to nasal decongestants	0	0	2.1 (28)	0	1+
Signs ^a					
Purulent secretion in nasal cavity	–	5.5 (42)	2.1 (34)	–	2+ 2–
Pain in bending forward	–	–	–	1.6 (52)	1+ 3–
Transillumination of sinus	0	0	1.6 (56)	0	1+
Blood tests ^a					
ESR > 10/20	2.9 (39)	1.7 (61)	0	0	2+
CPR > 10	1.8 (57)	–	0	0	1+ 1–
Predictive values					
Positive (numbers of factors)	0.68 (2 of 2)	0.86 (3 of 4)	0.80 (4 of 5)	Not stated	
Negative (numbers of factors)	0.74 (2 of 2)	0.53 (3 of 4)	0.66 (4 of 5)	Not stated	

^aAssociation given by likelihood ratio (frequency of trial in percentage)
– = no association; 0 = not investigated.

examination. Axelsson used sinus X-ray as the reference standard and found purulent rhinorrhoea, preceding upper respiratory infection, cough, hyposmia, and malaise to be predictors of bacterial sinusitis.¹⁹

Discussion

The literature search revealed only four studies eligible for

inclusion in this review. The two main reasons for exclusion of studies were the lack of an acceptable reference standard or a lack of relevant clinical information. Searches were not conducted for studies in languages other than English; however, previous reviews relevant to other aspects of acute sinusitis did not reveal further studies from general practice populations.^{7,8}

Table 4. Sensitivity and specificity of tests for sinusitis in adults.

Test	Sensitivity (%) (95% CI)	Specificity (%) (95% CI)
X-ray (air–fluid level or total opacity) ^a	0.73 (0.60–0.83)	0.80 (0.20–0.91)
X-ray (air–fluid level or total opacity or mucous thickening) ^a	0.90 (0.68–0.97)	0.61 (0.20–0.91)
Ultrasonography ^b	0.76 (range = 0.44–0.92)	0.76 (range = 0.52–0.91)
CT (air–fluid level or total opacity or mucous thickening) ^b	Unknown	0.76 (range = 0.58–0.84)
CT (air–fluid level or total opacity) ^c	Unknown	Unknown (PPV = 0.90)

^aData from Lau J, Zucker D, Engels EA, et al. *Diagnosis and treatment of acute bacterial rhinosinusitis. Evidence Report/Technology Assessment No. 9*. Rockville, MD: Agency for Health Care Policy and Research, March 1999. ^bData from Willett LR, Carson JL, Williams JW. Current diagnosis and management of sinusitis. *J Gen Intern Med* 1994; **9**: 38-45. ^cPersonal communication, Dr Jens G Hansen, Denmark, 1996.

In this review the focus was on symptoms, signs, and testing of patient (blood tests) that are independently associated with the diagnosis of purulent sinusitis. The review was based on studies from general practice with an unselected patient population. Four factors were found that were confirmed in at least two of the four studies: purulent secretion as a symptom and as a finding, pain in the teeth, and an elevated ESR. Among these four predictors, purulent secretion in the nasal cavity as a symptom was the strongest predictor in three of the four studies. In addition, two phases in the illness history — ineffectiveness of decongestants and transillumination of sinuses — may be of value. An ESR greater than 10 mm/h for males or greater than 20 mm/h for females and a CRP greater than 10 mg/l can also be of diagnostic value. The evaluation of the strength of each of the factors was based on the LR_s and the frequencies of the each symptom and sign.

In this review four different reference standards were accepted. Table 4 shows the properties of three of these compared with sinus puncture, indicating that they all have individual weaknesses. Ultrasonography is the least accurate, X-rays have a low specificity when using mucosal thickening as part of the inclusion criteria, and sinus CT has an uncertain sensitivity with the criteria used.

Although four different reference methods were used in the included studies, the four factors found were associated with the diagnosis of acute purulent sinusitis in two or three of the four studies, indicating that they are of clinical value. Two of the factors had only been investigated in one study each, but were found to be associated with the diagnosis. Three factors were confirmed in one study, but not confirmed in the remaining three, indicating that they are of questionable value. It has not been possible to pool the data into one larger meta-analysis. By using the four strongest predictors and, in addition, taking into consideration the two other predictors that have been confirmed in one study, GPs can increase the accuracy of their clinical diagnosis of acute purulent sinusitis. The findings of studies carried out among ENT patients^{18,19} were much the same as were found in this review, indicating the same predictors of acute purulent sinusitis.

Of equal importance, a number of clinical signs and symptoms that frequently have been presented in clinical guidelines, were not demonstrated to be of value in this review. In addition to the three that were not confirmed in three out of four studies identified (beginning with the common cold, unilateral maxillary pain, pain at bending forward), the following factors have been suggested, but not demonstrated to be of differential diagnostic value: bilateral pain over maxillary sinus; pain over frontal sinuses; headache; allergy; malaise; cough; anosmia and cacosmia; nasal congestion; fever with temperature greater than 38°C; tenderness over

maxillary and frontal sinuses; purulent pharyngeal discharge; and oedema over maxillary sinuses. Although many of these factors are frequent in patients with acute sinusitis, they are not specific enough to help in sorting out patients with acute purulent sinusitis.

The use of seven days' illness duration as a lower time limit to develop a bacterial sinusitis has been raised in some reviews, based on reasoning related to bacteriology and physiology.²⁰ Some of the data in this review indicate that a symptom duration of seven days or more may be of diagnostic value,^{1,3} but these data have not been analysed in a multivariate logistic regression.

In placebo-controlled treatment studies it was demonstrated that at least half of the patients with confirmed sinusitis recovered without antibiotic treatment.²¹ This indicates that only sinusitis patients with a high probability of having purulent sinusitis should receive antibiotic treatment. In many cases of an illness duration under seven days, an expectative attitude should be used. The signs and symptoms found in this review to be valid indicators of purulent sinusitis can also be helpful when considering antibiotic treatment. By use of these indicators, it should be possible to reduce the use of antibiotic treatment for patients with sinusitis. On the other hand, our review has demonstrated that the clinical differential diagnosis of purulent sinusitis is at best uncertain, with a moderate sensitivity. In cases with an uncertain diagnosis, GPs should thus choose to share the decision making with the patients, taking their context and their values into account when deciding on antibiotic treatment.

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